

remarks.

The amendments to this patent application are to revise independent claims 14, 17 and 18 to recite the terminology: "immediately after removing the semiconductor wafer from the polishing plate" so that the claim continues with "bringing the semiconductor wafer (...)." Support for this Amendment is found in the Specification on page 7, in lines 2-3.

The Applicants comment upon the prior art rejections of the claims as follows:

The present invention is directed to a process for treating a semiconductor wafer, comprising polishing the semiconductor wafer; immediately after polishing the semiconductor wafer removing the semiconductor wafer from the polishing plate; immediately after removing the semiconductor wafer from the polishing plate, bringing the semiconductor wafer into contact with an aqueous treatment agent solution for oxidizing a polished surface of the semiconductor wafer by action of the aqueous treatment agent solution, the wafer being brought into contact with the aqueous treatment agent solution in a manner which is selected from the group consisting of (a) spraying the semiconductor wafer with the aqueous treatment agent solution, (b) dipping the semiconductor wafer into the aqueous treatment agent solution and (c) applying the aqueous treatment agent

solution to the polished surface of the semiconductor wafer by means of a cloth which has been moistened with the aqueous treatment agent solution; and cleaning the semiconductor wafer.

The present invention also relates to the process step of storing the semiconductor wafer for at least 15 minutes in deionized water after contact with the aqueous treatment agent solution, before said cleaning of the semiconductor wafer.

Moreover, the present invention further relates to the method steps of flushing the treatment agent solution off the semiconductor wafer by using deionized water, after completing the oxidizing; and storing the semiconductor wafer for at least 15 minutes in deionized water after contact with the aqueous treatment agent solution, before said cleaning of the semiconductor wafer.

On page 4 of the Office Action, the Patent Examiner has contended that "Applicants' argument concerning the *Fabry et al* reference has been considered and is not deemed persuasive. The claims recite only immediate removal of the wafer from the polishing plate. There is no limitation in the instant claims that the wafer must be immediately oxidized as argued by the applicants. Therefore, the *Fabry et al* reference clearly reads on and encompasses the claimed process."

In order to overcome this statement by the Patent Examiner,

independent claims 14, 17 and 18 are being amended so as to point out the crucial difference over *Fabry et al.* Thus the terminology "immediately after removing the semiconductor wafer from the polishing plate" has been inserted into the claims, so that the sentence continues with "bringing the semiconductor wafer (...)." Support for the Amendment can be found in the Specification on page 7, lines 2-3.

The claimed process no longer reads on *Fabry et al.*, since the polished wafers are immediately treated with an oxidizing agent solution, whereas *Fabry et al.* teach freeing the polished wafers of polishing residues first. (See *Fabry* at column 5 lines 59 to 67.) It is an unexpectedly surprising result that wafers which are treated according to the invention are considerably protected against particle contamination and are free of etch marks even though they are not freed of polishing residues before the treatment with the oxidizing agent solution.

In addition, *Fabry* at columns 6 in lines 7 to 11, teaches that the wafers are stored in a polyethylene packaging unit. This is contrary to flushing and to storing the wafers in deionized water.

The deficiencies in the teachings of the primary reference *Fabry* are not overcome by the disclosure of the secondary reference *Hayashida*.

Hayashida in column 7 in lines 49 to 50 teaches that the silicon wafers can be immersed into the treating solution. However, there is no teaching as to the timing of this immersion by Hayashida. Also there is no teaching of using deionized water for flushing and storing of the wafers.

As to Hayashida US Patent No. 5,580,846, it is submitted that this reference is not pertinent at all. This patent refers to surface treatment agents and to a process for treating semiconductor wafers. However, there is no teaching at all that the treatment has to be performed at a specific time, i.e., immediately after having polished the semiconductor wafers and immediately after removing the wafers from the polishing plate. Moreover, the reference teaches having a complexing agent being present in the oxidizing treatment agent or rinsing the wafers with water containing a complexing agent after the treatment with the oxidizing treatment agent (please see column 3, lines 43-58).

Specifically, Hayashida discloses rinsing with an agent containing hydroxy amide groups in the molecule or a salt thereof. This agent is the complexing agent or a salt thereof.


This prior art process described above also requires that the treatment is carried out in the presence of a chelating agent having one or more phosphonic acid groups or a salt thereof in the molecule, an oxidized form thereof, or a polyphosphoric acid

or a salt thereof. (The chelating agent or an oxidized form thereof and the polyphosphoric acid or a salt thereof are abbreviated as "Fe-removing complexing agents".) These are in addition to the complexing agent containing the hydroxy amide moiety.

In summary, claims 14, 17 and 18 have been amended. In view of these amendments, it is believed that the present invention, and all the claims, are patentable over all the prior art applied by the Patent Examiner under 35 U.S.C. 103. Withdrawal of this ground of rejection is respectfully requested. A prompt notification of allowability is respectfully requested.

Respectfully submitted,
HEINRICH HENNHÖFER ET AL.

By:



Allison C. Collard, Reg. No. 22,532
Edward R. Freedman, Reg. No. 26,048
Attorneys for Applicant

COLLARD & ROE, P.C.
1077 Northern Boulevard
Roslyn, NY 11576
(516) 365-9802

ERF/mt

Encl.: Marked-Up Version of Amended Claim

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Assistant Commissioner of Patents, Washington, D.C. 20231, on November 6, 2001.


Lisa L. Vulpis

MARKED-UP VERSION
OF
AMENDED CLAIM

14. (Twice Amended) Process for treating a semiconductor wafer, comprising

polishing the semiconductor wafer;

immediately after polishing the semiconductor wafer removing the semiconductor wafer from a polishing plate;

immediately after removing the semiconductor wafer from the polishing plate, bringing the semiconductor wafer into contact with an aqueous treatment agent solution for oxidizing a polished surface of the semiconductor wafer by action of the aqueous treatment agent solution, [and]

the wafer being brought into contact with the aqueous treatment agent solution in a manner which is selected from the group consisting of (a) spraying the semiconductor wafer with the aqueous treatment agent solution, (b) dipping the semiconductor wafer into the aqueous treatment agent solution and (c) applying the aqueous treatment agent solution to the polished surface of the semiconductor wafer by means of a cloth which has been moistened with the aqueous treatment agent solution; and cleaning the semiconductor wafer.

17. (Amended) Process for treating a semiconductor wafer, comprising

polishing the semiconductor wafer;

immediately after polishing the semiconductor wafer removing the semiconductor wafer from a polishing plate;

immediately after removing the semiconductor wafer from the polishing plate, bringing the semiconductor wafer into

contact with an aqueous treatment agent solution for oxidizing a polished surface of the semiconductor wafer by action of the aqueous treatment agent solution,

the wafer being brought into contact with the aqueous treatment agent solution in a manner which is selected from the group consisting of (a) spraying the semiconductor wafer with the aqueous treatment agent solution, (b) dipping the semiconductor wafer into the aqueous treatment agent solution and (c) applying the aqueous treatment agent solution to the polished surface of the semiconductor wafer by means of a cloth which has been moistened with the aqueous treatment agent solution;

flushing the treatment agent solution off the semiconductor wafer by using deionized water, after completing the oxidizing; and

cleaning the semiconductor wafer.

18. (Amended) Process for treating a semiconductor wafer, comprising

polishing the semiconductor wafer;

immediately after polishing the semiconductor wafer removing the semiconductor wafer from a polishing plate;

immediately after removing the semiconductor wafer from the polishing plate, bringing the semiconductor wafer into contact with an aqueous treatment agent solution for oxidizing a polished surface of the semiconductor wafer by action of the aqueous treatment agent solution,

the wafer being brought into contact with the aqueous

treatment agent solution in a manner which is selected from the group consisting of (a) spraying the semiconductor wafer with the aqueous treatment agent solution, (b) dipping the semiconductor wafer into the aqueous treatment agent solution and (c) applying the aqueous treatment agent solution to the polished surface of the semiconductor wafer by means of a cloth which has been moistened with the aqueous treatment agent solution;

wherein the aqueous treatment agent solution comprises an aqueous solution of

- (1) from 0.02% to 3.0% by volume, based upon the total solution volume, of an oxidizing agent which is hydrogen peroxide;
- (2) from 0.01% to 2.0% by weight, based upon the total solution weight, of an alkaline component; and
- (3) the balance up to 100% by volume being water based upon the total solution volume, and the balance up to 100% by weight being water, which is based upon the total solution weight;

wherein the alkaline component is selected from the group consisting of tetramethylammonium hydroxide, ammonium hydroxide, potassium hydroxide, sodium hydroxide, potassium carbonate and the mixtures thereof; and
cleaning the semiconductor wafer.